

Respiratory Health Research at NIOSH

December 10, 2021 by Kristin J. Cummings, MD, MPH; Douglas O. Johns, M.S., Ph.D; Jacek Mazurek, MD, MS, PhD; Frank J. Hearl, SM, PE; and David N. Weissman, MD

The history of protecting workers' respiratory health pre-dates the creation of the National Institute for Occupational Safety and Health (NIOSH). In 1967 the Appalachian Laboratory for Occupational Respiratory Disease (ALFORD) was established within the U.S. Public Health Service (see related [blog](#)). ALFORD subsequently joined NIOSH in 1971, became the Division of Respiratory Disease Studies in 1977, and then the [Respiratory Health Division](#) (RHD) in 2015. A comprehensive history of respiratory health at NIOSH can be found in the article [NIOSH's Respiratory Health Division: 50 Years of Science and Service](#) in the Archives of Environmental & Occupational Health. Select highlights from the article and the past 54 years are included below.

Mining: Since the early years, preventing respiratory disease in coal miners has been a major focus. Inhaling coal mine dust can cause a range of lung diseases, including coal workers' pneumoconiosis (CWP), silicosis, mixed dust pneumoconiosis, and dust-related diffuse fibrosis, as well as chronic obstructive pulmonary disease (COPD).

- The Federal Coal Mine Health and Safety Act of 1969 (Coal Act) required a National Study of Coal Workers' Pneumoconiosis (NSCWP). Ultimately, four rounds of the NSCWP were carried out between 1969 and 1988. Data provided by these studies helped to support development of a NIOSH [Criteria Document](#) evaluating relationships between respirable coal mine dust exposure and risk of adverse health effects and recommendations for preventing respiratory diseases caused by inhalation of coal mine dust.
- National Coal Worker's Autopsy Study (NCWAS) determined if CWP or other lung diseases were present at death. Analysis of 6103 miners' autopsies processed by the program from 1971 through 1996 demonstrated a positive impact of coal dust regulation.
- The Coal Act established requirements for chest radiographic surveillance of coal miners. Surveillance is managed by a program now called the [Coal Workers' Health Surveillance Program](#) (CWHSP). Miners are offered screening at first entry into coal mining and then at approximately 5-year intervals during their mining careers. CWHSP has played a major role in tracking the burden of respiratory disease in coal miners and in detecting recent increases in pneumoconiosis affecting coal miners. Findings from the program over the past decade have highlighted CWP as a contemporary emerging issue. A 2005 report identified regional "hot spots" of rapidly progressive pneumoconiosis, particularly in certain parts of Appalachia. CWHSP findings also identified marked increases in prevalence of progressive massive fibrosis (PMF), the most severe form of pneumoconiosis in coal miners, after the late 1990s. Additional surveillance led to reports of large case clusters of coal miners with PMF receiving care at clinics in eastern Kentucky and western Virginia. Based in part on this research MSHA promulgated regulations in 2014 requiring enhanced protections.

Silica, Silicosis and Lung Cancer: Long before NIOSH came into existence, the U.S. Public Health Service studied silicosis in various industrial settings, including Vermont granite workers. Researchers in RHD continued and expanded on the study of the Vermont granite industry. This confirmed older findings showing that death from silicosis and tuberculosis were the major health threats before 1940, and also that there was excessive mortality from lung cancer in stone shed workers who had been employed prior to 1930 when there was exposure to high levels of granite dust. In the 1990s NIOSH researchers found excesses in lung cancer among workers in the North Carolina dusty trades silicosis registry that could not be explained by exposures other than silica. To explore the silica-silicosis-cancer relationship, NIOSH entered into an international partnership with the US National Cancer Institute and the Tongji Medical University in China to study Chinese workers exposed to silica-containing dusts. The study found that cancer risks were 22% higher among those workers who had silicosis. Working with MSHA and OSHA, NIOSH began a coordinated national initiative to control exposure to crystalline silica. NIOSH efforts included a campaign with the slogan, "*If it's silica, it's not just dust*" and three new documents to warn against the hazards of silica for [abrasive blasters](#), [rock drillers](#), and [construction workers](#). In 2002 NIOSH produced the [Hazard Review on the Health Effects of Occupational Exposure to Crystalline Silica](#) and contributed to the issuance of a new [OSHA standard for crystalline silica](#).

Health Hazard Evaluations (HHEs): Evaluating workplace safety and health concerns from workers and employers through the [HHE program](#) provides an important way to protect workers. Since 1970, RHD has carried out approximately 2,300 HHEs on respiratory issues at workplaces across the country. These evaluations not only provide a service to workers and employers but also allow the identification of novel respiratory hazards relevant to other workplaces. Starting in the 1990s, RHD carried out a series of HHEs addressing a newly recognized condition called flock workers' lung disease. This interstitial lung disease was first described in nylon flock workers, who had a unique pattern of lymphocytic bronchiolitis. The evaluations documented associations between respirable dust levels and adverse health effects including respiratory symptoms and reduced lung function parameters.

Another series of HHEs led to the recognition and characterization of the toxicity of inhaled chemical components of flavorings. An evaluation at a microwave popcorn facility where a cluster of former workers with a rare lung disease, obliterative bronchiolitis, had been identified, led to NIOSH's demonstrating that [diacetyl](#), a butter flavoring chemical, was harmful to the lung function of workers. Later HHEs highlighted the risk in other industries: bakery mix production; flavoring manufacturing; and coffee processing. These HHEs led to a 2003 [NIOSH Alert on flavorings](#) and stimulated NIOSH's establishment of recommended exposure limits for [diacetyl and 2,3-pentanedione](#) in 2016.

Byssinosis: Byssinosis is an airways disease with features of both asthma and COPD that occurs with exposure to cotton dust. In the early 1970s, the prevalence of byssinosis among US cotton workers was estimated at 20%. RHD contributed to a [1974 criteria document](#) that summarized the available evidence and recommended lowering the standard from 1 to 0.2 mg/m³. OSHA's 1978 Cotton Dust Standard incorporated NIOSH's recommendations, and included provisions for medical monitoring that effectively set national standards for spirometry. When concerns remained about exposures at lower levels, a series of remarkable experimental field studies demonstrated an exposure-response relationship between airborne endotoxin (but not dust concentration) and reduced lung function, suggesting that endotoxin was responsible for the acute response to cotton dust. The preventive effectiveness of washing cotton to reduce endotoxin concentration also was demonstrated. This work contributed to a NIOSH [Current Intelligence Bulletin on cotton washing](#) methods and an amendment by OSHA to the Cotton Dust Standard. OSHA has concluded that the Cotton Dust Standard had the effect of reducing the prevalence of byssinosis to less than 1%.

Indoor Air Quality/Asthma: Several research projects sought to better understand and prevent adverse respiratory health effects of exposure to indoor dampness and mold as concerns were raised in hospitals, schools, and office buildings. A longitudinal investigation of a water-damaged state office building demonstrated that new-onset asthma was associated with building occupancy, upper respiratory symptoms predicted subsequent development of lower respiratory symptoms, hydrophilic fungi and endotoxin were associated with adverse health effects, and while relocation of ill employees during remediation was health-protective, extensive remediation efforts were not fully successful in improving respiratory illness. This research led to a [NIOSH Alert on indoor dampness and mold](#) and the [NIOSH Dampness and Mold Assessment Tool](#), a practical instrument for systematic evaluation of buildings that can be used to prioritize remediation.

Population Surveillance: Population surveillance to track the burden of work-related respiratory disease and occupational respiratory hazards in the US has been an important component of RHD efforts. In addition to other surveillance efforts, NIOSH published the [first Work-Related Lung Disease \(WoRLD\) Surveillance Report in 1991](#). This report presented data for asbestosis, CWP, silicosis, byssinosis, exposure to cotton dust, hypersensitivity pneumonitis, toxic agents, dust diseases of the lung, and CWP compensation for 1968–1987. In 2008, the seventh and [final WoRLD Surveillance Report](#) was published. This report consisted of two volumes and covered a time period between 1968 and 2004. To continue to provide surveillance information and access to data for public health action, a web-based platform called "[eWoRLD](#)" was launched in 2008. This format presents up-to-date summary tables, graphs, and figures on the occurrence of pneumoconiosis, asthma, COPD, malignant mesothelioma and other respiratory conditions as well as selected related exposure data.

Asbestos/Libby Vermiculite/Diesel Exhaust: A 1987 NIOSH report described a dose-response relationship for lung cancer mortality associated with workers' exposure to asbestos fibers found in vermiculite mined and processed near Libby, Montana. A follow-up report in 2007 confirmed increased risk for lung cancer mortality and demonstrated increased risk for cancer of the pleura (mesothelioma) in these workers. These studies also documented increased mortality from nonmalignant respiratory disease and asbestosis, respectively. Finally, a large study was conducted to evaluate risk of lung cancer mortality in workers exposed to diesel exhaust particulate at eight US nonmetal mines. A cohort mortality study found increased risk of lung cancer, esophageal cancer, and pneumoconiosis in the cohort compared to state-based rates.

Respiratory Health Monitoring: Spirometry, a type of pulmonary function test, is inexpensive and informative, but challenging to perform correctly. The [NIOSH Spirometry Training Program](#) is responsible for approving course sponsors to train participants on how to perform spirometry. NIOSH-approved spirometry training is required by Federal Law for individuals

performing spirometry testing on workers exposed to cotton, coal, and silica dusts. RHD has made substantial contributions to national guidelines for spirometry published by the American Thoracic Society. RHD has conducted spirometry research including the development of the [Spirometry Longitudinal Data Analysis \(SPIROLA\) software](#), a program for tracking longitudinal spirometry and identifying individualized thresholds for excessive decline.

Chest radiography is another important part of occupational respiratory disease surveillance. RHD has a long history of efforts to ensure the availability of physicians able to perform ILO classification of chest radiographic images. The NIOSH [B-Reader Program](#) aims to ensure competency in radiographic reading by evaluating the ability of readers to classify a test set of radiographs, thereby creating and maintaining a pool of qualified readers having the skills and ability to provide accurate and precise ILO classifications.

Celebrating the NIOSH 50th anniversary allows the opportunity to look back on some of the many respiratory research accomplishments over the years. The Respiratory Health Division is committed to continuing our work to protect workers and looks forward to the next 50 years.

Kristin J. Cummings, MD, MPH, is the HESIS Section Chief in the Occupational Health Branch of the California Department of Public Health (formerly with the NIOSH Respiratory Health Division).

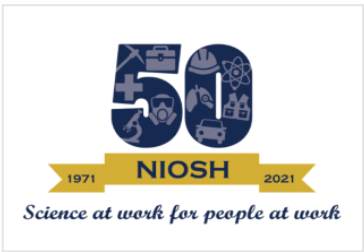
Douglas O. Johns, M.S., Ph.D, is Director of the NIOSH Spokane Mining Research Division.

Jacek Mazurek, MD, MS, PhD, is the Surveillance Branch Chief in the NIOSH Respiratory Health Division.

Frank J. Hearl, SM, PE, is Chief of Staff in the NIOSH Office of the Director (formerly Respiratory Health Division, 1976-2002).

David N. Weissman, MD, is Director of the NIOSH Respiratory Health Division.

This blog is part of a [series](#) for the NIOSH 50th Anniversary. Stay up to date on how we’re celebrating NIOSH’s 50th Anniversary on our [website](#).



December 10, 2021 by Kristin J. Cummings, MD, MPH; Douglas O. Johns, M.S., Ph.D; Jacek Mazurek, MD, MS, PhD; Frank J. Hearl, SM, PE; and David N. Weissman, MD
[50th Anniversary Blog Series, Respiratory Health](#)

Post a Comment

Your email address will not be published.

Comment

All comments posted become a part of the public domain, and users are responsible for their comments. This is a moderated site and your comments will be reviewed before they are posted. [Read more about our comment policy »](#)

Name

Email

Post Comment

